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Case report

A totally laparoscopic peritoneal free flap for reconstruction of hand

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ABSTRACT

Management of defects on the hand and foot with exposed tendons remains a major challenge for plastic surgeons. Here, we present a case of hand reconstruction with a totally laparoscopic peritoneal flap. The anterior rectus sheath was preserved in situ. The peritoneal free flap supplied by peritoneal branches of the deep inferior epigastric artery was retrieved by laparoscopy to cover the soft tissue defect of the hand. The defect of the dorsal hand was 17 cm × 12 cm. The peritoneal flap measuring 22 cm × 15 cm survived completely without any complications. A following split-thickness skin graft offered the successful wound closure. Motor and sensory function improved gradually within the first year follow-up. The totally laparoscopic peritoneal free flap is a good choice for reconstruction of the soft tissue defects accompanied by exposed tendons on the hand and foot.

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Introduction

Despite advances in plastic surgery, reconstruction of soft tissue defects with exposed tendons on the hand and foot remains a challenge. There are several reconstruction options, including skin grafts, local flaps, distant flaps and free flaps.^{1–3} However, the experience over the past 20 years has demonstrated that tissue reconstruction with flap would lead to adhesion of tendon and functional impairment at the recipient site.^{4–6} The posterior rectus sheath-peritoneal free flap, developed by Salgado et al., has been used for coverage of the hand and foot.⁷ They proposed that the peritoneum interposition might reduce adhesion formation in surgery of exposed extensor tendons of the hand and foot.

Traditionally, the peritoneal free flap was retrieved by making a paramedian incision under direct vision.⁷ Considering underlying tendon excursion, we developed a totally laparoscopic peritoneal free flap. This flap was supplied by the peritoneal branches of the deep inferior epigastric artery. Here, we present the flap design and operative technique, along with one case report.

Case report

A 30-year-old woman was involved in a machine accident, with extensive soft tissue defects. After debridement and repair of tendons, the patient received vacuum sealing drainage (VSD) treatment. Extensor tendons, metacarpal bones and carpus were exposed (Fig. 1). The existing defect of the dorsal hand was 17 cm × 12 cm. The peritoneal flap measuring 22 cm × 15 cm retrieved by laparoscopic surgery was transplanted to cover the defect (Figs. 2 and 3). The peritoneal flap survived two weeks postoperatively and no postoperative complications were observed (Fig. 4). The remaining wound received a skin graft and the abdominal wall demonstrated a satisfying appearance (Fig. 5). The function of the injured hand recovered partially within the first year follow-up (Fig. 6).

Under general anesthesia, the patient was placed in a supine position. After radical debridement, repair of extensor tendons and VSD treatment, the size of the defect measured 17 cm × 12 cm (Fig. 1). By using the laparoscopic system, pneumoperitoneum was created through an optiview trocar placed in the subumbilical position. A laparoscope was introduced through this port and two other trocars were placed in the right and left lower abdominal wall. The peritoneal branches of the deep inferior epigastric artery could be detected videolaparoscopically. The bilateral pedicles of the flap were divided through laparoscopic procedures using the ultrasonic-activated scissors. The flap was then harvested according to the size of tissue defect. The bilateral deep inferior epigastric

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Fig. 1. A 30-year-old woman presented with an extensive skin and soft tissue defect following radical debridement and VSD treatment.

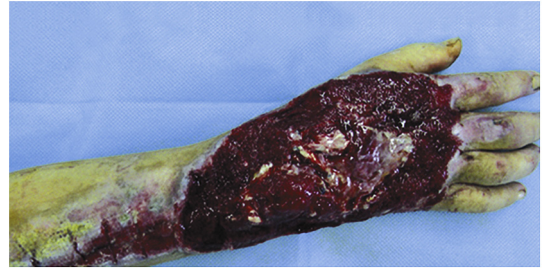


Fig. 4. The flap demonstrated a complete survival two weeks postoperatively.

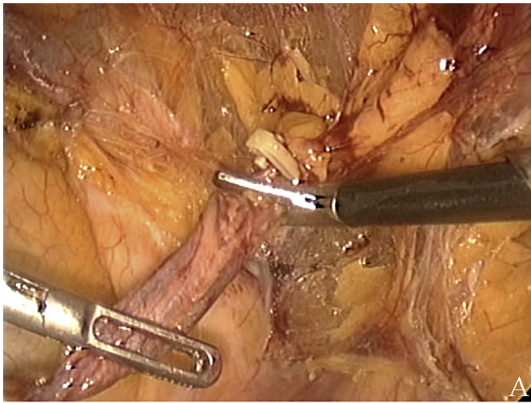


Fig. 2. The totally laparoscopic peritoneal free flap was dissected.



Fig. 5. The minimal invasive surgery showed a good cosmetic result at the donor site.



Fig. 6. The function of the injured hand recovered partially during the first post-operative year.

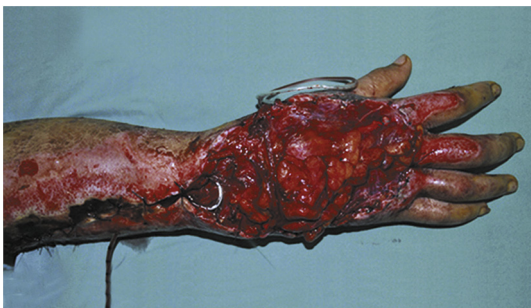


Fig. 3. The totally laparoscopic peritoneal free flap was transplanted to cover the defect of the dorsal hand.

artery was carefully isolated, double clipped and then transected at its origin to maximize pedicle length and diameter. The resected peritoneal flap was obtained through the subumbilical port.

The peritoneal free flap was transplanted to cover the defect with exposed tendons, metacarpal bones and carpus. We placed the peritoneal surface of this flap against the extensor tendon surface. The deep inferior epigastric artery and its accompanying veins, as pedicles of the peritoneal free flap, were anastomosed to the radial artery and cephalic vein.

After survival of the peritoneal flap, the skin defect was covered by a split-thickness skin graft. Assessment of sensation and motor function was done during the follow-up.

Discussion

Reconstruction of extensive soft tissue defects accompanied by exposed tendons and/or skeleton on the hand and foot continues to be a challenging issue for plastic surgeons. The skin grafts, local flaps, distant flaps and free flaps have become the most popular procedures to cover soft tissue defects. These above mentioned treatment regimens will inevitably involve severe tendon adhesion.^{2,5,8} Although various biochemical and physical methods have been adopted to decrease adhesion formation, most of the results are unsatisfactory.^{9–11} A thin flap that easily supports a skin graft and provides a gliding surface for tendon coverage represents an ideal option. Other important factors include minimal donor-site morbidity and an acceptable cosmetic result.

The peritoneum acts as a physiological barrier in prevention of abdominal adhesion, and thus, a similar mechanism may apply to tendon coverage. Salgado et al firstly introduced the posterior rectus sheath-peritoneal free flap for reconstruction of hand and foot.⁷ They dissected the peritoneal flap by making a paramedian incision under direct vision. So disadvantages associated with their procedure were potential abdominal wall herniation and postoperative ileus. Some of their patients did experience a prolonged postoperative ileus.⁷

Compared with the Salgado's technique, our totally laparoscopic surgery has following advantages. The totally laparoscopic peritoneal flap with bilateral pedicles allows a larger size, across median line. The donor site receives minimal invasive surgery. No abdominal wall herniation and postoperative ileus were observed in our study. A more cosmetically acceptable result was obtained in both the donor site and the recipient site.

The need for skin graft coverage is the potential disadvantage. Creating one-stage reconstruction without following skin grafting might be achieved by introducing the concept of a chimeric flap, which can resurface the exposed tendons and provide cutaneous wound coverage simultaneously.

In conclusion, the totally laparoscopic peritoneal free flap is a good choice for reconstruction of the hand and foot with exposed tendons. However, larger clinical trials and long-term follow-up are required to support the recommendation of this flap.

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